POPULATION DENSITY OF MALLOPHAGA ON THE *PHASIANUS COLCHICUS*

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by

Robert Jay Weselmann

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by

Robert Jay Weselmann

Approved by Committee:

Leland P. Johnson

Harold J. Swanson

F. Emmitt Jacob

Ford I Caufield
Dean of the Graduate Division

1629-17

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CHAPTER I

INTRODUCTION

Statement of the problem. The purpose of this study is to determine the population density of Mallophaga on the ring-necked pheasant (Phasianus colchicus). At present very little is known about the density of the ectoparasites on many of our wild game birds. This information would be of importance to wildlife management and farmers alike. Parasites might be a contributing factor in the population cycles of pheasants. Game birds are thought not to be reservoirs for parasites of farm birds, but more documentation is needed.

The ring-necked pheasant was first introduced into Iowa in 1900 and since then, through the effort of the Iowa Conservation Commission and interested individuals, has grown to over a two million bird harvest. With such a large number of birds taken and a season that stretches from November to January, this bird is one of the most important game birds in Iowa.

Introduction to the Mallophaga. The bird parasites of the order Mallophaga are small wingless insects with a broad head, two clawed tarsi, and are swift runners. The eggs are fastened by a gluey substance to the feathers of the host.[1]

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[1]Vernon L. Kellogg, New Mallophaga (Palo Alto, California: Leland Stanford Jr. University, 1896), p. 60

As parasites on the feathers, these insects are in a constant environment with the temperature maintained by the host's body heat. These insects show incomplete metamorphosis, so it is possible to find young and various instars along with the adult insect at any time of the year. The young resemble the adults in form but are usually white; they change colors as they mature and as adults may be found in various shades of browns, yellows and black.[1]

The food requirements of these insects consist of epidermal scales or feathers of the host. According to Ash these insects are extremely specific as to feathers.[2] A parasite from the wing could not survive on the head feathers and vice versa. The jaws are either heavily or weakly chitinized and are equipped for biting rather than sucking. Kellogg reports several examples of Mallophagian crops containing blood, but he feels that these instances were due mainly to previous injury to the host.[3] Ash also reports blood cells in the crops of some insects.[4] As stated previously, the main food consists of epidermal scales and feathers ground up by the mandibles.

The temperature range of the parasite seems to vary.

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[1]E. O. Essig, Insects of Western North America (New York: The MacMillan Company, 1926), pp. 126-7.

[2]J. S. Ash, "A Study of the Mallophaga of Birds With Particular Reference to Their Ecology," Ibis, CII (January, 1960), 94.

[3]Kellogg, loc. cit.

[4]Ash, op. cit., p. 94.

A foreign reference in the Biological Abstracts by Zhotorzycka states that Mallophaga are capable of living and multiplying two to four weeks after the death of the host.[1] Ash states that Mallophaga are very sensitive to temperature changes. In his experiments a thermocouple was used to set the temperature of a blackbird's head skin at 37-38°C. Ash feels that the various instars of Mallophaga development require different temperatures and achieve this by migration up and down the feathers. He based this on the fact that under laboratory-controlled temperatures large numbers of incubator-bred nymphs died.[2] In the case of the parasites found on Iowa pheasants by the author of this paper, it was observed that the insects could remain alive up to two weeks at room temperature in a bottle containing the feathers on which they were found. Lipeurus maculosus nymphs were observed molting under these conditions.

The parasite lives its whole life on the host, so the only chance of infection is by actual contact with other members of the host species. Contacts during copulation or from parent to young in the nesting season are the most common periods of transfer. Another possible chance for transmission would be in periods of the year when the host species are grouped for protection and food gathering.[3]

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[1]Jadwiga Zhotorzycka and Jerry Danecki, "Observations on Vitality of Mallophaga from Dead Wood Grouse," Wiadomosci Parazytol, VIII (February, 1962), 30.

[2]Ash, op. cit., p. 95.

[3]Kellogg, loc. cit.

The host and the parasite. The relationship of the pheasant and its ectoparasites must be one of happy harmony; the literature gives little evidence of severe reactions of the host birds. The references to host damage for the most part pertain to other birds. The main damage caused by the parasite is irritation. The insect feeds on feathers and epidermal scales; this may lead to weight loss and lowered resistance to disease. Under normal conditions an equilibrium seems to exist between host and parasite.[1]

The normal ectoparasite population is kept under control by preening and dust baths. Pheasants preen and dust each day as though on a definite schedule. No reports were found as to whether pheasants eat the parasites picked off during preening, but Ash states:

> It is highly probable that birds remove many parasites from themselves by preening, but that these are apparently distasteful to them is shown by the almost complete lack of records of any ectoparasites being found in the bird's digestive system.[2]

The health and vigor of the bird seems to be the principle determining factor for a dense population of parasites. In a study of 762 pheasants, all pen-reared, the heaviest infection found was among birds affected with some

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[1] I. F. Keymer, J. H. Rose, W. N. Beesley and S. F. M. Davies, "A Survey and Review of Parasitic Diseases of Wild and Game Birds in Great Britain," The Veterinary Record, LXXIV (August 18, 1962), 894.

[2] Ash, loc. cit.

other affliction.[1] An example of how the population can be affected by abnormality of the host is provided in a study by Johnson and Long. One hundred thirty birds of various species were examined. Many were louse free or showed less than twenty lice per bird. One case of a bird with a gross infection was stated. A female grackle with a malformed beak was found carrying 373 lice and a large number of eggs.[2] Ash also gives several examples of this type. A willow warbler was found with a crossed mandible and was covered with adults, nymphs, and eggs of a species of Menoponidae. An English house sparrow with a malformed beak was found with a large population of Menoponidae.[3] Fowl such as chickens also show an increase in the number of parasites after debeaking.[4] In debeaking with the removal of the tip of the upper mandible, the bird loses some of its effective preening ability.

The only report found in the literature of actual death was recorded by Keymer, Rose, Beesley, and Davis in which a heavy infestation of lice killed three young pen-reared red-legged partridges.[5]

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[1] Keymer, op. cit., p. 96.

[2] J. C. Johnson, Jr. and C. A. Long, "Common Grackle Heavily Infested with Mallophaga," The Wilson Bulletin, LXXII (March, 1960), 107.

[3] Ash, op. cit., p. 96.

[4] Ibid.

[5] Keymer, op. cit., p. 893.

In the case of the pheasant we must look at the bird and its habits to see when and how parasites could be contracted. The pheasant is a ground nesting bird with the hen incubating for about twenty-nine days. It is doubtful that parasites such as Mallophaga are transferred until the feathers appear on the chicks.[1] For a period of about three weeks contact between the hen and the chicks would be close enough for exchange. As the chicks mature, they become less dependent on the hen for warmth and protection at night. Each chick roosts by itself, so there would be little chance of exchange of parasites. As was stated in the section on Mallophaga, the insects do not live long after removal from the host and food supply. With the arrival of cold weather and snow, pheasants group together for roosting and to acquire food. These groups can change from day to day, so there is a possibility of parasite exchange. However, the factor of temperature specificity of the Mallophaga might limit the movement of the insect during cold weather. In Richard Taber's studies of the breeding habits of pheasants, the year is divided into several sections. From January to mid-March Taber found birds in groups with a fairly regular roosting, feeding, and nesting pattern. In mid-March the groups began to disperse to spring cover area. The next chance for exchange of parasites would come during the period

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[1]Ash, op. cit., p. 99.

of courtship and mating from April to June. From this period until the grouping in November, the chance for exchange of parasites on the adult male pheasants is very slim. The dominant cock in an area comes in contact with the hens until June, and then contact between the sexes ceases. During the mating period from April to June the non-dominant cocks would have little chance to pick up any new parasites.[1]

Ash, in studies on other species of birds, relates seasonal fluctuations of infection:

> A marked peak of infestation rate occurs in some of the species under review just prior to the birds' breeding season, and in five species there is a marked reduction in the infestation of adult birds just after the breeding season.[2]

The rise in population could insure the transfer of the parasite from the mother to the young.

In regard to the degree of parasitism and the number of parasites in a bird population, a few references were found. A sample of 1,561 birds of various species showed 65% with Mallophaga.[3] Another instance was recorded of 15,000 wild birds examined with less than .1% showing a heavy infes-

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[1]Richard Taber, "Observations on the Breeding Habits of the Ring-necked Pheasant," The Condor, LI (July-August, 1949), 153-175.

[2]Ash, op. cit., p. 99.

[3]T. C. Maa and J. S. Kuo, "A Field Survey of Arthropod Parasites of Birds in Taiwan," Journal of Medical Entomology, I (January, 1965), 395-401.

tation of Mallophaga.[1] Ash records a population of fifty-four black birds with twenty-one free of parasites and thirty-three harboring some parasites. Ash also examined 129 birds of various species and found thirty to be parasitized.[2]

Records of Mallophaga identified on the ring-necked pheasant. In 1950 K. C. Emerson listed two species of Mallophaga found on the ring-necked pheasant in the United States. The first paper states Goniodes colchici as described by Denny in 1847 in England to be found on pheasants in this country.[3] Emerson also lists Lagopoecus colchicus found on pheasants studied in Utah, Michigan, Illinois, and Montana. L. colchicus was first described by Emerson in 1949.[4]

In 1951 Emerson compiled a check list of Mallophaga found on North American gallinaceous birds. In this paper Emerson states:

> Contrary to much published literature the author was unable to find many instances of lice infesting birds which were not considered the normal hosts. The only exception encountered was the presence of

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[1] R. Meinertzhagen and Theresa Clay, "List of Mallophaga Collected from Birds Brought to the Society's Prosectorium," London Zoological Society Proceedings, CXVII (February, 1948), 675-679.

[2] Ash, op. cit., p. 109.

[3] K. C. Emerson, "New Species of Goniodes," Journal of Kansas Entomological Society, XXIII (October, 1950), 125.

[4] K. C. Emerson, "The Genus Lagopoecus (Philopteridae: Mallophaga) in North America," Journal of the Kansas Entomological Society, XXIII (July, 1950), 99.

> Cuclotogaster heterographus (Nitzsch) normally found on domestic chickens, on hatchery-reared ring-necked pheasants from California Game Farm, Ontario, Canada, and Ithaca, New York.[1]

Included in the check list were the following Mallophaga from the pheasant: (1) Cuclotogaster heterographus (Nitzsch) California, New York, Ontario (2) Goniocotes chrysocephalus (Giebel) Montana (3) Goniodes Colchici (Denny) California, Iowa, Montana, Oregon, British Columbia, Ontario (4) Lagopoecus Colchicus (Emerson) Illinois, Michigan, Montana, Utah (5) Lipeurus maculosus (Clay) Connecticut, New York, Oregon, Wisconsin, British Columbia (6) Menacanthus sp., Illinois, British Columbia (7) Oxylipeurus colchicus (Clay) Illinois.[2]

Again in 1956 Emerson lists Cuclotogaster heterographus (Nitzsch) from pen-reared ring-necked pheasants. He also lists Menacanthus stramineus (Nitzsch) on pen-reared pheasants. It is Emerson's belief that the above two species would be unlikely to maintain normal breeding populations in the wild state.[3]

Richard O. Malcomson recompiled the list of Mallophaga

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[1] K. C. Emerson, "A List of Mallophaga from Gallinaceous Birds of North America," Journal of Wildlife Management, XV (April, 1951), 193.

[2] Ibid., 195.

[3] K. C. Emerson, "Mallophaga (Chewing Lice) Occurring on the Domestic Chicken," Journal of Kansas Entomological Society, XXIX (April, 1956), 65.

on various species of hosts in North America in 1960. His check list includes: (1) Amyrsidea megalosoma (2) Cuclotogaster heterographus (3) Gonicotes chrysocephalus (4) Goniodes capitatus (5) Goniodes Colchici (6) Lagoperus colchicus (7) Lipeurus maculosus (8) Oxylipeurus colchicus recorded on the ring-necked pheasant.[1]

Keymer, Rose, Beesley, and Davis record five species of Mallophaga that are common to both pheasants and domestic fowl, when both birds are raised in close proximity. In this study done in England the following dual parasites were recorded: (1) Menacanthus stramineus (2) Lipeurus caponis (3) Lipeurus heterographus (4) Gonoides dissimilis and (5) Gonoicotes gallinae. However, they also state:

> Wild birds are unlikely to be important reservoirs of these ectoparasites. A remarkably small number of birds carrying ectoparasites communicable to domestic birds were encountered in the present survey.[2]

In Iowa two studies have been concluded, one by Harold James Stockdale in his work with the chicken body louse Menacanthus stramineus. In his survey of the pheasant population for presence of Menacanthus stramineus, Stockdale shot fifty-seven pheasants over a two-season period. No M. stramineus were found, but the following parasites were recorded: (1)

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[1]Richard O. Malcomson, "Mallophaga from Birds of North America," The Wilson Bulletin, LXXII (June, 1960), 188.

[2]Keymer, op. cit., p. 893.

Amyrisidea megalosoma (Overgaard) (2) Lipeurus maculosus (Clay) (3) Goniocotes chrysocephalus (Giebel) and (4) Goniodes colchici (Denny).[1] David J. Roslien's work with pheasants and disease in Iowa showed two species of Mallophaga. The purpose of Roslien's study was not to check for parasitest, but the insects were recorded only when noticed by the investigator. The birds checked were pen-reared pheasants, and the species recorded were Lipeurus maculosus (Clay) and Goniodes colchici (Denny).[2]

Thus, four species of Mallophaga have been recorded on Iowa pheasants. Goniodes colchici (Denny) was recorded by Emerson, Stockdale and Roslien. Lipeurus maculosus (Clay) was recorded by both Roslien and Stockdale. Stockdale records Goniocotes chrysocephalus (Giebel) and Amyrisidea megalosoma (Overgaard).

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[1]Harold James Stockdale, "Biology of the Chicken Body Louse, Menacanthus Stramineus" (unpublished Ph.D. thesis, Iowa State University of Science and Technology, Ames, 1964), p. 44.

[2]David J. Roslien, "Incidence of Disease Antibodies in Pheasants and Pheasant Management on Game Farms and Shooting Preserves in Iowa" (unpublished Ph.D. thesis, Iowa State University of Science and Technology, Ames, 1966), pp. 135-6.

CHAPTER II

MATERIALS AND METHODS

In order to study ectoparasites of wild pheasants, the primary problems became obtaining the pheasants and removing the parasites from the pheasant. At first the parasites were to be removed from living pheasants caught in the Iowa Conservation Commission's night lighting program. A method of removal of parasites from living birds using Dry-Die 67 was tried, but this procedure only recovered a portion of the parasites.[1] The method was tried using pigeons and pheasants. The pigeons were dusted with Dry-Die 67 and placed in a plastic bag, covered with a paper sack. The birds were allowed to move in the bag. After a fifteen minute period the pigeons were removed and checked for parasites. The pigeons showed a large number of parasites remaining. Several pheasants were also tried and only a portion of the pheasants' parasites were recovered. This method was the only one described in the literature for quick removal of ectoparasites from living birds, and it was abandoned. The decision was made to obtain the needed pheasants during the hunting season from November 11, 1966, to January 2, 1967.

With the help of Lorna Weselmann and Alvin Weselmann, fifty pheasants were obtained during the hunting season. As

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[1]Robert C. Dalgleish, "An Improved Technique for Collecting Bird Ectoparasites," Turtox News, XLIV (February, 1966), 75.

a pheasant was killed, it was immediately placed in a plastic bag and sealed with a rubber band. At the close of each hunt, the bird was removed from the plastic bag and skinned over a white paper. Any parasites falling off at this time were placed in a small vial containing 70% alcohol. The date, number of birds taken that day, and the area of the hunt were recorded on the vial. The head, skin, and wings were then placed back in the original plastic bag. The bag containing the skin was then placed in a deep freezer. After freezing for a period of at least a week, the skins were removed. Over a piece of white paper the skins were vigorously shaken and brushed with a comb. The parasites that fell were again placed in the proper vial. A large percentage of the parasites could be found in the bottom of the plastic bag in most cases of pheasants with parasites. Each skin was examined closely for any remaining parasites. The skin was then placed back in the proper bag and refrozen. A second check of the skins was made. This check in all cases except one showed negative results.

The parasites were kept in the vial containing 70% alcohol until slides were made. Two types of slides were made. Deep depression slides were used for one group. Using a turntable, a ring of gold size was built up. This ring was allowed to set for a day. Then a fresh ring of gold size was added on top of the first. Using a pipet the parasites were removed from the vial and placed in the depression of the slide. Any alcohol was drawn off using a small eye dropper.

A one per cent Formalin solution was then added to the depression until the fluid built a concave bulge above the slide top. The cover slip was then lowered gently onto the bulge of one per cent Formalin to avoid trapping air bubbles. Slight pressure was applied to the cover slip to force out the excess fluid and to spread the gold seal. The slides were then allowed to set for seventy-four hours before observing. In many instances a longer period could be used, as the gold seal requires more time to set.

The second type of slide was made using a clearing solution so the genital organs of the male parasite could be observed for classification. A microscope slide was placed on the turntable and a small ring of gold seal was built up. The gold seal was then allowed to set for two days. The ring should be just high enough to prevent crushing of the parasites by the cover slip. No second layer of gold seal was added to this slide. Hoyer's solution composed of fifty milliliters of distilled water, fifty milliliters of gum arabic, and two milliliters of chloral hydrate was used, as it acts as a clearing and mounting agent.[1] The resulting syrupy solution was added, drop by drop, into the center of the gold size ring. A small dissecting needle was used to remove the parasites from the 70% alcohol. The parasites

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[1]Peter Gray, The Microtomists' Formulary and Guide (New York: The Blakiston Company, Inc., 1954), p. 632.

were placed in the Hoyer's solution on the slides and positioned using the dissection needle. The cover slip was then allowed to gently settle, thus smoothing the material beneath it. These slides were allowed to set for two days before observations were made on them.

The slides prepared were used for counting and identification of the ectoparasites.

CHAPTER III

RESULTS

The slides were examined and the parasites found on the pheasants were of four species. (See Table I.) Lipeurus maculosus (Clay) was identified from the key by Clay.[1] Gonicotes chrysocephalus (Giebel) was identified from the original key by Giebel.[2] Goniodes colchici (Denny) was identified from the key by Denny.[3] Amyrisidea megalosoma was identified by Harold J. Stockdale, Entomologist, Iowa State University, Ames, Iowa. L. maculosus (Clay), G. chryso cephalus (Giebe) and G. colchici (Denny) were checked by Dr. Stockdale and the identifications were confirmed.

The pheasants examined totaled fifty birds with twenty-seven showing some degree of parasitism. The majority of the birds came from Winneshiek County, and six were obtained from Polk. The number of parasites per bird ranged from two to fifty. Table II indicates the number of each species of parasite per bird.

L. Maculosus was the most common species with twenty-

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[1]Theresa Clay, "A Revision of the Genera and Species of Mallophaga Occurring on Gallinaceous Host," London Zoological Society Proceedings, Sect. B, CVIII (January, 1938, 116.

[2]Christoph Gottfried Andreas Giebel, Insecta Epizoa (Leipzig: O. Wigand, 1874), p. 189.

[3]Henry Denny, Monographia Anoplurorum Britanniae, (London: H. G. Bohn, 1842), pp. 158-159.

TABLE I

NUMBER OF BIRDS EXAMINED AND THE TOTAL NUMBER OF PARASITES OF EACH SPECIES PRESENT

Sp. 1 *Lipeurus maculosus*
Sp. 2 *Goniocotes chrysocephalus*
Sp. 3 *Goniodes colchici*
Sp. 4 *Amyrisidea megalosoma*

Date	Number Birds Examined	Number Birds Infected	Cummulated % Infection	Number Parasites Sp.1	Sp.2	Sp.3	Sp.4
Nov. 12	3	1	33%	2	0	0	0
Nov. 13	1	1	50%	19	0	0	0
Nov. 15	1	1	60%	2	0	0	0
Nov. 19	3	1	50%	2	0	0	0
Nov. 22	2	0	40%	0	0	0	0
Nov. 24	1	0	36%	0	0	0	0
Nov. 25	2	0	31%	0	0	0	0
Dec. 18	1	0	28%	0	0	0	0
Dec. 22	4	0	22%	0	0	0	0
Dec. 23	2	2	30%	4	0	0	0
Dec. 24	4	0	25%	0	0	0	0
Dec. 25	3	3	33%	19	3	1	1
Dec. 27	3	3	40%	20	0	0	0
Dec. 28	4	2	41%	17	7	0	0
Dec. 30	6	4	45%	48	16	10	7
Dec. 31	7	6	51%	95	28	16	11
Jan. 2	3	3	54%	18	2	0	0
Total	50	27	54%	250	57	27	19

TABLE II

COMMULATED POPULATION DENSITY ON INFECTED BIRDS

Sp. 1 *Lipeurus maculosus*
Sp. 2 *Goniocites chrysocephalus*
Sp. 3 *Goniodes colchici*
Sp. 4 *Amyrisides megalosoma*

Date	#	Total Sp. 1 on Bird	Cum. Pop. of Sp.1	Total Sp. 2 on Bird	Cum. Pop. of Sp.2	Total Sp. 3 on Bird	Cum. Pop. of Sp.3	Total Sp. 4 on Bird	Cum. Pop. of Sp.4
Nov. 12	1	2	2	0	- -	0	- -	0	- -
Nov. 13	2	19	10.5	0	- -	0	- -	0	- -
Nov. 15	3	2	7.6	0	- -	0	- -	0	- -
Nov. 19	4	6	7.2	1	1	0	- -	0	- -
Nov. 23	5	2	6.2	0	- -	0	- -	0	- -
	6	2	5.5	0	- -	0	- -	0	- -
Dec. 25	7	3	5.1	0	- -	0	- -	1	1
	8	7	6.3	1	1	0	- -	0	- -
	9	9	5.8	2	1.3	1	1	0	- -
Dec. 27	10	7	5.9	0	- -	0	- -	0	- -
	11	10	6.3	0	- -	0	- -	0	- -
	12	3	6	0	- -	0	- -	0	- -
Dec. 28	13	7	5.6	0	- -	0	- -	0	- -
	14	10	6.3	7	2.7	0	- -	0	- -
Dec. 30	15	15	6.8	11	4.4	3	2	1	1
	16	23	7.9	0	- -	6	3.3	2	1.3
	17	2	7.6	5	4.5	0	- -	2	1.5
	18	8	7.6	0	- -	1	2.8	2	1.6
Dec. 31	19	16	8.5	3	4.3	5	3.2	1	1.5
	20	33	9.3	3	4.1	2	3	2	1.7
	21	0	- -	0	- -	0	- -	3	1.8
	22	21	9.8	0	- -	3	3	3	1.9
	23	2	9.5	0	- -	1	2.8	2	1.9
	24	23	10.1	22	6.1	5	3	0	- -
Jan. 2	25	6	9.9	1	5.6	0	- -	0	- -
	26	8	9.8	0	- -	0	- -	0	- -
	27	4	9.6	1	5.2	0	- -	0	- -

six of the twenty-seven parasitized birds showing this parasite. Adults and nymphs of L. maculosus were found on the wing feathers. These individuals were surprisingly hardy in view of what the literature had stated. Several times because of lack of 70% alcohol L. maculosus were placed in a vial with a feather and lived for a period of over two weeks at room temperature. Molting of the nymphs occurred during this period as was evidenced by the empty skins. The adults and nymphs must have consumed food from the feather, for a large number of droppings were found in the bottom of the vial. This would substantiate the data reported by Zhotorzycka and Danecki. A total of two hundred fifty specimens of L. maculosus were recorded. This would be an average of nearly ten L. maculosus per bird for the twenty-six parasitized birds.

Gonicotes chrysocephalus was the second most numerous parasite recorded. A total of fifty-seven adults and nymphs were found mainly on the body feathers. Only one bird showed a significant number of G. chrysocephalus. Pheasant number twenty-four harbored twenty-two G. chrysocephalus both young and adults. This same bird also showed twenty-three L. maculosus. The ten other pheasants infected with G. chrysocephalus were hosts to from one to eleven parasites. Of the parasitized birds sixteen were free of this type of parasite. G. chrysocephalus specimens were only found on birds that also showed an infection of Lipeurus maculosus.

Goniodes colchici was recorded on nine of the twenty-seven parasitized birds. Twenty-seven specimens of G. colchici

were found on the body feathers. All of the birds infected with G. colchici were also infected with L. maculosus.

Amyrisidea megalosoma was recorded on ten pheasants of the twenty-seven parasitized. The density of A. megalosoma was even lower than Goniodes colchici, as only nineteen examples of A. megalosoma were recorded on the parasitized group of pheasants. (See Figure 1.)

Each species was examined for the number of males, females, and young. Only L. maculosus showed a population with any evidence of a normal breeding colony. The population of L. maculosus seems to go up as the winter progresses. An increase in the number of young L. maculosus is noted. (See Figure 2.) This could be due to several factors. To the left of Figure 2 would be the period of the molt. During the molt parasites are lost. This seasonal reduction could be followed by an attempt by L. maculosus to reestablish a thriving population. Another factor and probably more significant could be the grouping of pheasants for feeding and protection. December 24 was the first significant snowfall. After this snow a significant rise was noted in the population density of parasites per bird. The snow and cold weather caused the birds to be found in bunches ranging from ten to twenty birds. The pheasants were found in pine groves or other areas of dense cover in both Polk and Winneshiek Counties. These birds are in close contact at various periods of the day and parasites could easily be transferred. Pheasants were observed dusting on dry gopher mounds that were

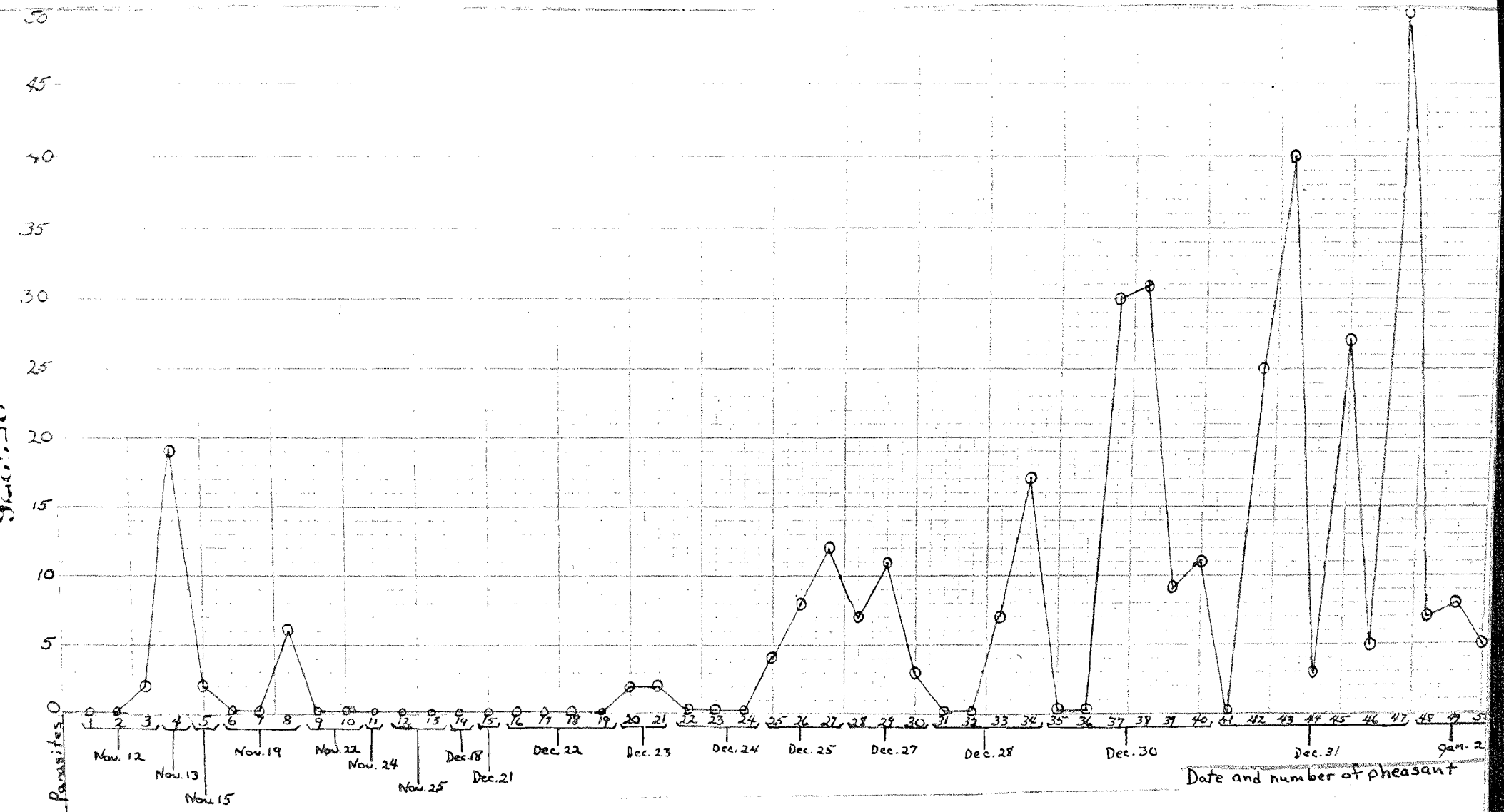

Figure 1. Total Number of Parasites Per Bird in Relation to Date Bird was Collected.

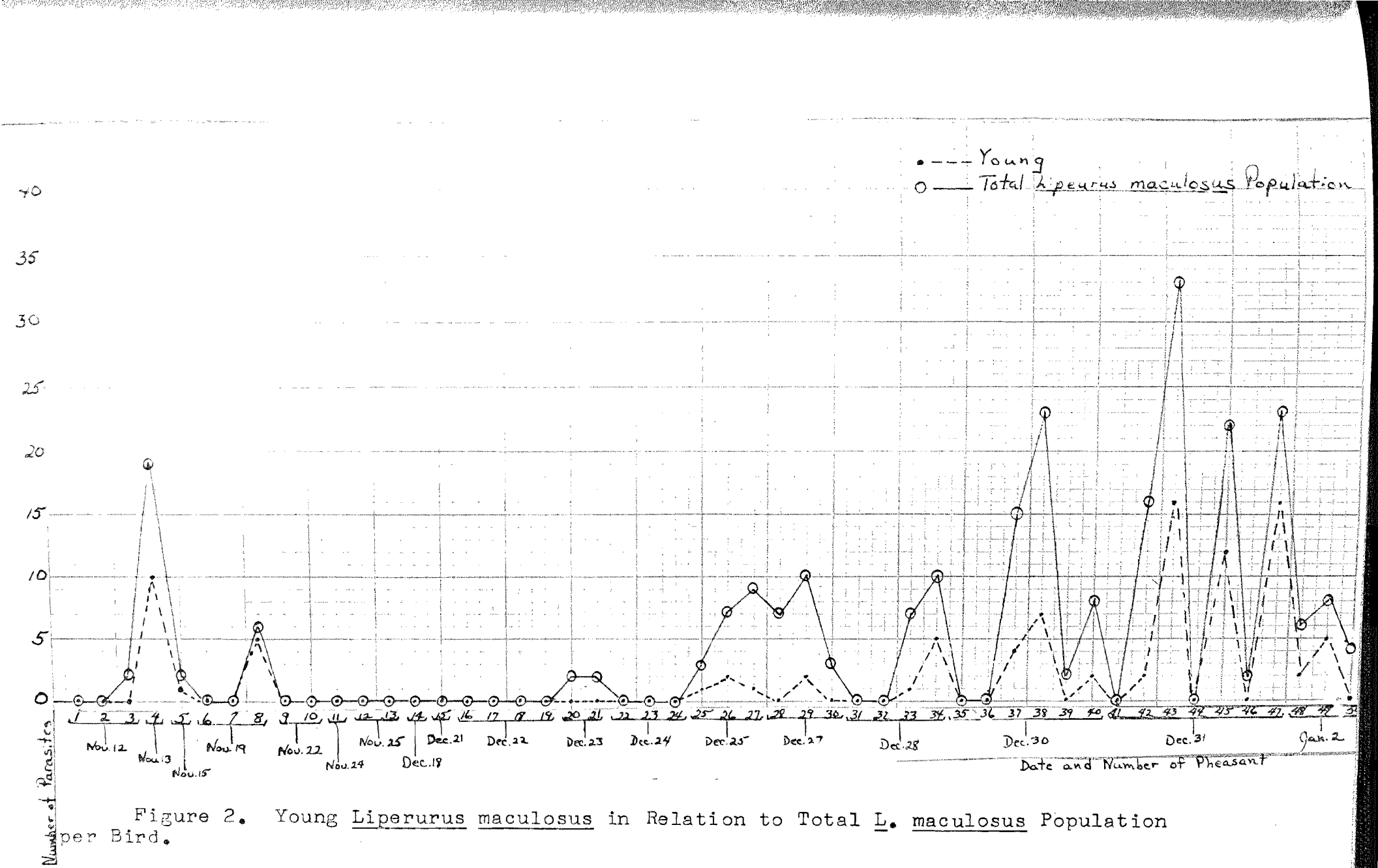

Figure 2. Young Liperurus maculosus in Relation to Total L. maculosus Population per Bird.

above the snow. Several birds used the mounds, and as has already been discussed, some of the parasites could live for the short period of time required for one bird to leave the dusting bowl and a second to start to dust. As all of the birds examined were cocks, no knowledge of the population of parasites on the hens is available. It is possible that older hens may harbor a larger population which could be spread to younger birds at this time. No bird taken showed noticeable feather damage. No population of parasites on any bird was considered to be pathological.

The population density of Mallophaga on a wild healthy male pheasant appears to be insignificant. Even the birds with the highest population showed no effects of the parasites. All of the birds examined were healthy and showed no malformations. It is entirely possible that if any one of these pheasants had a deformity of any type, the parasites could increase to a population that could cause damage to a grown pheasant. In conversation with Dr. Stockdale, it was found that although his work was not concerned with density of parasites, he did note on his fifty-seven birds a very low population of ectoparasites.[1] All of the parasites recorded were native to the pheasant; no chicken or domestic fowl parasites were recovered.

The density of the parasite population seems to be a

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[1] Statement by Harold J. Stockdale, personal interview.

factor correlated with weather and crowding of the birds. Pen-reared pheasants show more parasites than wild birds. Dr. Roslien stated that some birds in captivity were so thickly infested that the parasites crawled off on his hands.[1] In pen conditions it is possible for rapid transfer and a quick population explosion of ectoparasites. A similar situation can be found on a small scale in nature. Birds are forced to group because of weather conditions. This grouping allows any infected birds to spread parasites to the others.

Parasites species population seemed to be dependent on what species are present. With one exception only the birds showing infections of L. maculosus harbored G. chryso-cephalus, or G. colchici, or A. megalosoma, or any combination of the three.

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[1]Statement by David J. Roslien, personal interview.

CHAPTER IV

SUMMARY

The problem of this research consisted of trying to find species density of Mallophaga on the ring-necked pheasant.

Previous work with ectoparasites of birds has been done by Ash, and Keymer, Rose Beesley, and Davis in Great Britain. In the United States Emerson and Malcomson have compiled lists of various birds and their common parasites. Stockdale and Roslien have worked instances of various species of Mallophaga on Iowa pheasants.

The pheasants taken in this study were placed in plastic bags in the field to avoid losing parasites. The birds were skinned, and the skins were frozen to facilitate quick removal of the ectoparasites. Slides were prepared for aging, sexing, and species indentification of the parasites.

Fifty birds were taken from Polk and Winneshiek Counties in Iowa from November 17 to January 2nd. Of the birds taken twenty-seven or fifty-four per cent showed some degree of parasitism. Four species were recovered, Lipeurus maculosus, Goniocotes chrysocephalus, Goniodes colchici, and Amyrisidea megalosoma. No birds taken showed a population capable of severely damaging the bird. The highest population of ectoparasites found was fifty, consisting of three species. The population of parasites seems to rise along

with the grouping of pheasants caused by cold weather.

In conclusion the normal male pheasant seems capable of keeping parasites under control. The balance could shift in favor of the parasite with some malformation of the bird or with crowding conditions.

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